

IN THE SPECIFICATION

Page 1, please replace the paragraph beginning at line 5 with the following:

The present invention relates to an apparatus and method of assembling a heat exchanging tube for a heat exchanger capable of automatically assembling heat exchanging tubes, which serve as heating tubes, cooling tubes or the like, applied to a heat exchanger (for example, a feed water heater, a boiler, a humidity separating and heating unit, a ground steam evaporator, and a cooling unit for cooling cooling water, condensed water, oil or the like) which is provided with thermal power generation plants, nuclear power generation plants and the like as an accessory.

Page 1, please replace the paragraph beginning at line 17 with the following:

An example of a prior art device will be first described with reference to FIG. 19 and FIG. 20. This example relates to an assembly of heat exchanging tubes as heating tubes in a horizontal type feed water heater used in thermal power generation plants, nuclear power generation plants and the like.

Please replace the paragraph bridging pages 1 and 2 with the following:

FIG. 19 schematically shows how the tubes are assembled to the feed water heater. The feed water heater is generally composed of a cylindrical frame 1 in which are accommodated a multiplicity of U-shaped tubes 2 called heating tubes into which circulating water flows and a tube bundle is formed by the tubes. The respective tubes 2 are assembled by being inserted into the holes 4 of a plurality of partitions 3 disposed in parallel with each other from an open end side with the U-shaped curved portions of the tubes 2 on a bent end side directed longitudinally.

Please replace the paragraph bridging pages 6 and 7 with the following:

Further, since the tubes 2 must be conveyed from the packing cases 17 disposed as described above to the work table 8, the work for lifting them by the crane or the like is

increased as well as when the crane is used for other work, the tube conveying job must be interrupted. As described above, the assembly of the heat exchanging tubes in heat exchanger executed by the prior art method has various problems such that the tubes are inefficiently assembled because a large number of workers are required and many complicated manual jobs are necessary and the space in which the packing cases are disposed is increased.

Page 10, please replace the paragraph beginning at line 1 with the following:

The tube grasping means and the tube taking-out means constitute a set formed of a tube taking-out unit in operative combination thereof and a plurality of sets of the tube taking-out units which are disposed with an interval along a longitudinal direction of the taking-out portion support arm.

Page 17, please replace the paragraph beginning at line 10 with the following:

Conventionally, when a job which is executed using a crane is needed in a heat exchanging tube assembly job, since the tube assembly job depends on how other jobs are proceeded, there is a possibility that an idle time is caused to the tube assembly job itself. According to the embodiment, however, such an adverse affect does not arise and working time can be saved because of the automatic assembling operation. Further, since the tube grasping means, which can directly take out a necessary number of the tubes from the tube accommodation means such as packing case is provided for the assembling apparatus, a hanging-down job by a crane is not necessary while the tubes are inserted. Thus, a job using the crane can be minimized and a working process can be also shortened.

Page 18, please replace the paragraph beginning at line 11 with the following:

Since the tubes have a small diameter and a long entire length, when the tubes left in a piled-up state are lifted up, they are liable to cause a load shift. Since the support arm is added to the hanger as a countermeasure for preventing the load shift in the tube grasping

means, when the tube grasping means is provided with a multiplicity of units having the same mechanism, such can reduce the load applied on a single unit, such that the size of the unit itself can be reduced.

Please replace the paragraph bridging pages 18 and 19 with the following:

Since the base portion of the apparatus is arranged as the cantilever arm type by the employment of the L-shaped frames, the packing case can be set up in the state that one side of the apparatus is opened. Thus, the frames do not obstruct operation and space can be saved. As to the inserting job of the tubes, the tubes which have been taken out and placed at a stock position can be securely taken out one by one by the tube taking-out means and effectively and securely inserted by the tube feed-out means and the insertion of the tubes can be securely completed. Further, since the apparatus of the embodiment can be divided into several units, the apparatus can be accommodated by being divided into the units when it is not used, by which a storing space can be minimized.

Please replace the paragraph bridging pages 25 and 26 with the following:

The reversing beam 27 is provided with tube grasping means 28 for taking out a predetermined number of the tubes 13 from the packing case 22 in a lump, tube positioning means 29 for positioning the grasped tubes at the inserting positions to the holes 15 of the partitions 14 and tube taking-out means 30 for sequentially taking out the tubes 13 grasped by the tube grasping means 28 one by one. The tube grasping means 28 and the tube taking-out means 30 are combined with each and constitute a set of a tube taking-out unit 31. A plurality of the tube taking-out units 31 are intermittently disposed along the longitudinal direction (X-direction) of the taking-out portion support arm 26 and adapted to take out the U-shaped tubes 13 from the packing case 22 by grasping both sides thereof at a plurality of positions along the longitudinal direction thereof and to stock them at predetermined inserting

positions as well as make preparation for inserting the tubes 13 by taking them one by one from their stocked position.

Please replace the paragraph bridging pages 27 and 28 with the following:

The hanger 33 is composed of a slightly wide rectangular thin sheet and disposed with its surface set in parallel with the longitudinal direction of the tubes 13 as well as an end thereof bent to have an L-shape is supported by a pair of rail-like linear guides 36 provided with the reversing beam 27 through sliding engagement portions 37. A screw shaft 39, which is normally and reversely rotated by a drive motor 38 provided with the reversing beam 27, is disposed at the center between the linear guides 36 in parallel therewith and screwed with a nut portion 40 disposed to the hanger 33, so that the hanger 33 can be reciprocally moved in the Y-direction by the rotation of the drive motor 38. Further, since the linear guides 36 are secured to the reversing beam 27, the hanger 33 is turned integrally with the reversing beam 27 about the X-axis center, so that the hanger 33 approximately in a horizontal state in FIG. 1 can be approximately vertically lowered by the turn of the reversing beam 27 as shown in FIG. 2. The screw shaft 39 is covered with a screw shaft cover 41 to prevent drops of oil being applied thereto.

Please replace the paragraph bridging pages 29 and 30 with the following:

Then, the screw shaft 39, is rotated by driving the drive motor 38 to thereby move the hanger 33 along the linear guides 36 so as to cause the hanger 33 to approach the tubes 13. Specifically, first, the hanger 33 is abutted against a side surface of one of the sides of the U-shaped tubes 13 as well as the hook 34 is inserted below the lowermost tube 13. Next, the support arm 35 is turned from the horizontal state shown by the solid line to the vertical state shown by the virtual line in FIG. 2 to thereby abut the support arm 35 against the other side surface of the above side of the tubes 13 so as to grasp the tubes 13. Further, the other

grasping means, which is not shown, adjacent to the above-noted grasping means is also operated at the same time to grasp the other side of the tubes 13.

Please replace the paragraph bridging pages 30 and 31 with the following:

Thereafter, when the hanger 33 is turned upward about 90° on the drawing paper from the state shown in FIG. 2 by the turn of the reversing beam 27, the hanger 33 is set approximately horizontal as shown in FIG. 3. As a result, a plurality of the tubes 13 are supported laterally on the hanger 33 with the U-shaped curved portions at the bent ends of the tubes kept in a vertical state, which is the state shown in FIG. 1, in which the respective sides of the tubes 13 are disposed on an upper side and a lower side. Thereafter, the taking-out portion support arm 26 and the reversing beam 27 which serve as the tube positioning means 29 are driven to thereby move the tubes 13 in the Y-direction and Z-direction and turn them about the X-axis so that the tubes 13 are set to the tube inserting positions. The plurality of grasped tubes 13 are then sequentially taken out one by one by the tube taking-out means 30 from the tube located at the extreme end of the hanger 33 to thereby make preparation for inserting the tubes 13 to the side of the partitions 14.

Please replace the paragraph bridging pages 31 and 32 with the following:

As shown in FIG. 2 and FIG. 3, the tube taking-out means 30 includes a push-out rodless cylinder 46 disposed on the surface of the hanger 33 in confrontation with the support arm 35. An end of the rodless cylinder 46 is coupled with a rotary actuator 47 disposed to the upper end of the hanger 33 and the other end thereof is turned about the Y-axis. As a result, the rodless cylinder 46 can move to the position (position in FIG. 3) where it becomes parallel with the support arm 35 by turning 90° from the position (position in FIG. 2) where it is disposed linearly with the support arm 35. A pushing piece 49, which is formed to have an approximately an L-shape when viewed from a side surface, is provided with a rodless cylinder head 48 as a moving piece disposed on the side of the side surface of the rodless

cylinder 46. The pushing piece 49 is moved to the hook 34 side after the rodless cylinder 46 is disposed in parallel with the support arm 35 in the state that the tubes 13 are horizontally grasped as shown in FIG. 3, by which the plurality of tubes 13 grasped by the hanger 33 and the support arm 35 are pushed out to the hook 34 side. However, the push-out action is executed in a state that the extreme end side of the hanger 33 is closed by the hook 34 as shown by a solid line in FIG. 3 and stopped in a state that the respective tubes 13 are aligned on the hook 34 side. After the alignment, the hook 34 is turned as shown by a virtual line in FIG. 3 to thereby open the extreme end side of the hanger 33 and a grooved roller 50 to be described below pulls out one of the tubes 13 located on the extreme end side in this state.

Please replace the paragraph bridging pages 39 and 40 with the following:

There is provided a function for automatically determining the position where the tube 13 is inserted, the function being arranged such that when the initial tube is inserted, the alignment of the tube is carried out by manual operation and then the position where the next tube 13 is inserted is automatically indexed from the initial position of the tube 13 on a coordinate. Accordingly, the requirement of a subsequent alignment job can be omitted. A similar function can be applied to the tube taking-out means 30, in which case the hanger 33 can be automatically moved to the position of the tube which is taken out from the packing case 22 without the need for adjustment relating to the width of the tube 13, the processing position and the like.

Page 46, please replace the paragraph beginning at line 4 with the following:

After the necessary tubes 13 are taken out by the tube taking-out means 30, the remaining tubes 13 are spaced apart from the spacers 104 and are liable to cause a load shift. To prevent the load shift, there is provided simple tube support jigs 110 each including a small piece 107 which will be placed on the remaining tubes 13 and rods 109 which are coupled with both the ends of the tubes 13 by nuts 108 or the like and hung down along both

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the sides of the tubes 13 as shown in FIG. 11.